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PNEUMATIC TOOLS AND APPLIANCES IN FOUNDRY SERVICE.

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In discussing the employment of pneumatic tools and appliances in foundry work, it is not my purpose to describe any device not perhaps familiar to you all, but rather to present, in as brief and collective a form as the subject permits, the various appliances which have lightened labor and reduced costs in foundry service, that are dependent upon compressed air as their actuating medium.

The introduction of pneumatic tools in a form marketably perfected for shop or foundry usage dates back but a few years, and their wide-spread adoption, remarkable for its rapidity, is, after all, the most convincing proof of their commercial value. To-day a boiler shop or machine shop devoid of compressed air equipment is a rarity, and if the foundry end of our mechanical community is not so well provided for, I venture to say that it is because the merits and labor-saving properties of pneumatic machinery have not, in the rapid development of the business, been as thoroughly demonstrated to the foundry trade. The day is near at hand, however, when a foundry without pneumatic equipment cannot produce its output in commercial competition with foundries that have adopted it.

The best known and most widely employed foundry appliance actuated by compressed air is the pneumatic hoist, originally used only in the straight lift, piston and cylinder form, but now utilized in a variety of types.

The accompanying view shows collectively the vertical hoist and the horizontal style, the latter being desirable when available head room is scant. The horizontal hoist may be arranged for a lift of 2 feet or 4 feet for each foot of piston travel, when desired. Operated by a smiple three-way valve, with no com-

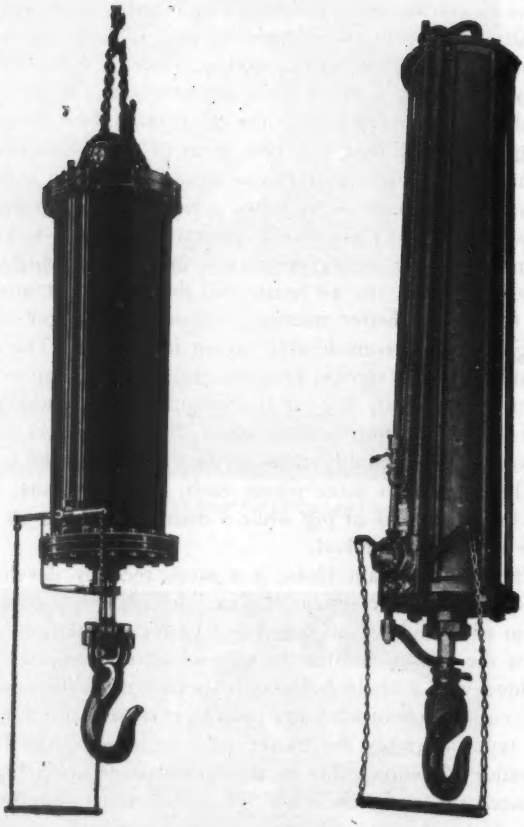
Pneumatic Hammer for Chipping Castings.

Pneumatic Hammer for Chipping Castings.

plicated mechanism, these hoists are well nigh indispensable for duty not requiring an immovably sustained load. For this latter demand, where irregular action is not permissable, a more refined type of hoist is obtainable in which the incompressible qualities of oil are used to govern and restrain the sometimes too elastic properties of compressed air. This is accomplished by providing the hoist with a hollow piston rod filled with oil, thereby preventing a more rapid movement of the piston in its upward travel, than emission of the oil through the necessary controlling valve will permit. This form of hoist eliminates that element of danger which otherwise would be present in handling vessels of moulten metal, and also permits a sort of elastic positiveness which is so essentially desirable. In the actual work of moulding, as in lifting copes and moulds, drawing patterns and moving cores, the air hoists will do 50 per cent. more work in an easier and better manner, without the danger of losing castings and with considerable saving in repairs. The peculiar adaptability of this device, properly rigged, as a drop or casting breaker, is apparent, since it is evident that the sudden release of the load could not possibly affect the regular and even progress of the piston in its return stroke. This machine will break three half-pigs into three pieces each, in one minute, and can easily break 20 tons of pig while a man is breaking up one ton by the old sledge method.

The Motor Chain Hoist is a more recently developed appliance, intended for similar service, and embodies compactness of form with rapid, even speed and perfect regulation. It consists of the motor familiar to all users of pneumatic drills, so combined with a chain hoist as to permit quick movement, accurate suspension of load and prompt reversibility. One of the latest types operates the motor in a bath of oil, avoiding the annoyance sometimes due to insufficient lubrication because of the inaccessible location in which the hoist must operate. These hoists, with adequate pressure, are made in sizes to lift up to 10,000 pounds in weight, at speeds varying from 10 to 36 feet per minute.

A most useful foundry appliance, familiar to you all, is the Pneumatic Hammer for chipping castings; in fact, so general has become the adoption of this invaluable tool, that the mere presentation of it in the accompanying views, showing a few of



Straight Line Pneumatic Foundry Hoists.

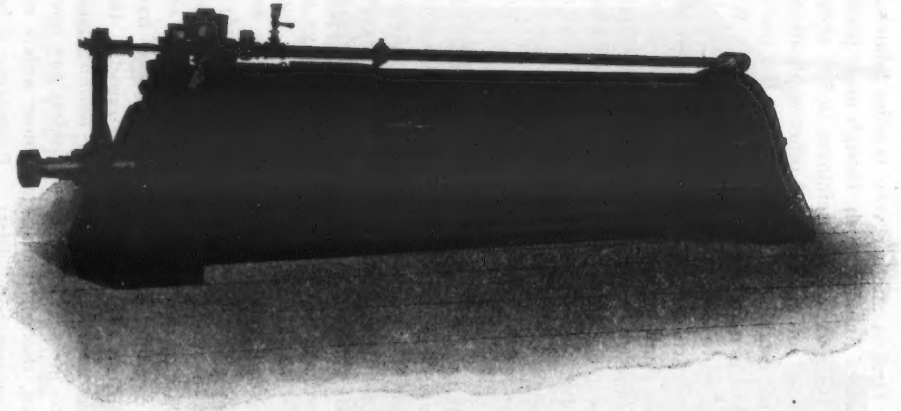
its best known forms of application, will suffice, supplemented by the general statement that one man with one of these tools will customarily do the work of four men following the old methods.

The Air Drill is another very familiar labor-saving device in some classes of foundry work, though more peculiarly a tool possessing a wide variety of usefulness in the shop, where for drilling, reaming, rolling flues, and other applications seemingly limitless, it has established itself, next to the pneumatic hammer, as the most generally used type of air tool. When a large, heavy casting is to be broken up for return to the cupola, a small pneumatic drill may be advantageously used to drill a suitable number of small holes into which may be inserted a round taper steel wedge which, with a few well directed hammer blows, will sever the piece into parts suitable for remelting.

The application of the drill motor equipped as a casting cleaner, will appeal to you as a saver of labor and money without further argument when its immense speed and power are considered.

One of the most recently perfected pneumatic devices suitable only to foundry requirements, is the Pneumatic Sand Rammer, now shown in its most improved form. Accurately counterbalanced, the weight of this tool completely rigged is not quite 300 pounds, and operated under an air pressure of 40 pounds per square inch it will deliver an average of 300 blows per minute. The maximum stroke is 7 inches, but the length of stroke and consequently the number of blows delivered, may be changed at the will of the operator by simply varying the proximity of the rammer to the work. It is estimated that a greater quantity of sand can be rammed in a more effectual manner by this machine, than five men can do by hand.

Passing from the Sand Rammer, possibly the newest of pneumatic contrivances to serve the foundryman's needs, we reach what to me seemed to be the oldest and one of the most widely known, though perhaps not most widely used, of them all—the Pneumatic Sand Blast. Embracing a broad field of application and in some way adapted to the needs of almost every known form of foundry work, the adoption of the Sand Blast has been retarded somewhat through patent limitations and ultra-conservative methods of introduction. Another objec-

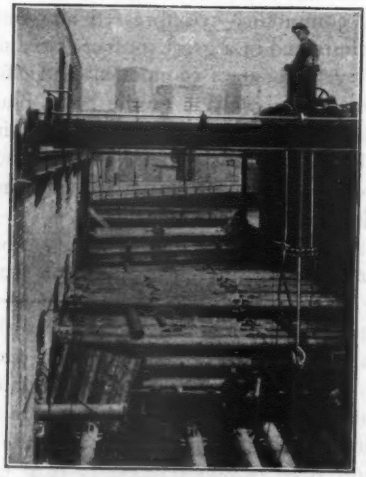


Horizontal Foundry Hoist.

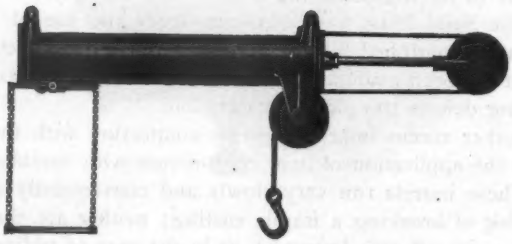
tion has been its wasteful utilization of what was formerly a most expensive commodity—compressed air—but this element of criticism is eliminated in a great measure because of the rapid strides in the development of economical and efficient air compressing machinery. The value of the Sand Blast for foundry use, if obtainable at proper operating cost, being universally conceded, I will sum up my reference to this device by quoting from the pamphlet of a manufacturer, treating the subject from an argumentative standpoint:

"The question is asked, does the Sand Blast pay, for foundry use? And is answered with the qualification that it is difficult to approximate on general work. The argument continues, that on ordinary iron, steel, brass and bronze castings, one man operating a Sand Blast apparatus consuming 120 feet of cubic air per minute, will clean more surface and remove more cores in a given time than is possible for from six to ten men to do with the hammers, chisels and brushes, and the finished work left by the Sand Blast is infinitely better than can possibly be produced by hand laborers. Burned sand or scale is removed rapidly by the blast, and not only does it effect a great saving in time and labor, but a further saving is effected on castings to be machined; the removal of the oxide in itself is a great saving on tools, and in many cases the tools can be run at an increased speed. This applies particularly to milling cutters. Difficult and intricate cores are readily removed, and in cleaning steel castings in which large quantities of wire nails are used, the sand is eaten away first, and subsequently the nails will fall to the ground, sand blasted, perfectly clean, and in condition to be used over again. In a number of foundries where the Sand Blast has been introduced the use of facings has been discontinued. In some cases the only objection, in fact, that has been made to the Sand Blast is an unpleasant habit of making defects too plainly discernable.

Another recent improvement in connection with the Sand Blast is the application of it in conjunction with tumbling barrels. These barrels run very slowly and consequently there is slight risk of breaking a fragile casting; neither are the edges of them worn off and destroyed, as in the case of ordinary rattling at high speed. The castings are not cleaned by tumbling, but by sand blast inserted at one or both ends of the barrel.



Pneumatic Crane in Pipe Foundry.



Compound Lift, Horizontal Foundry Hoist.

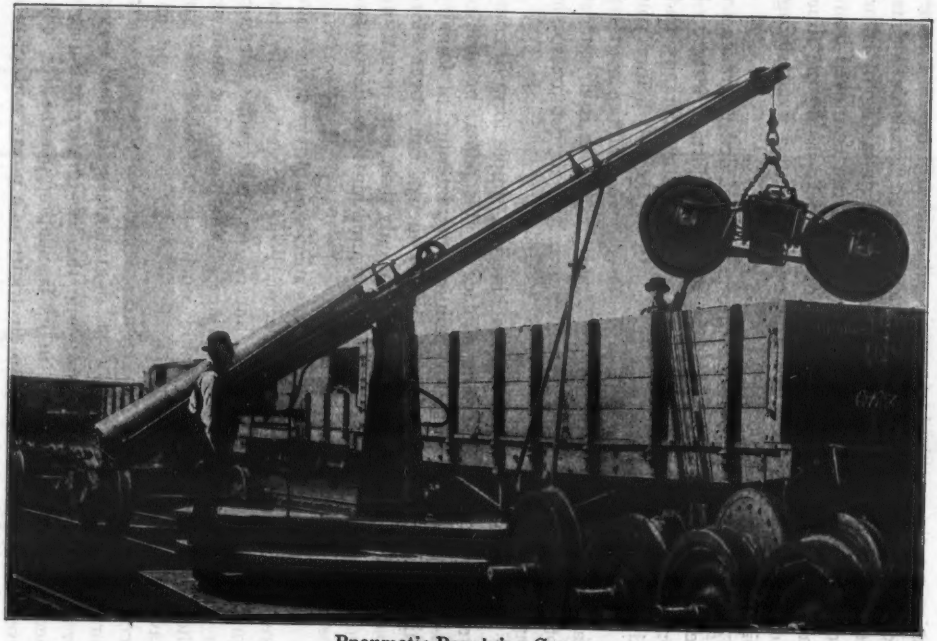
The usual time consumed in cleaning a charge of this barrel is from 20 to 30 minutes.

The device next shown is a Pneumatic Sand Sifter, representing another method of utilizing the air drill motor for the needs of the foundry. With compressed air available for its operation, the value of this apparatus through saving of labor and attention becomes readily apparent. It can be moved from place to place in the performance of its work, saving the time and labor otherwise required to convey sand to a fixed sifting point.

I have refrained purposely from any detailed reference to the Pneumatic Moulding Machine, a most important feature of compressed air foundry equipment, because the economy and value of this device have been so recently placed before you in a paper devoted exclusively to the subject. Suffice it to say that the Pneumatic Moulding Machine presents in itself a most potent argument for the introduction of the air compressor in foundry service.

The Pneumatic Painting Machine is a simple form of compressed air device deserving a place in this paper, because of its exceptional economy for painting the interiors of foundry buildings. One man with this handy utensil can cover more space and distribute the paint more evenly than four men using ordinary paint brushes. The air consumption is moderate and the results all that can be desired.

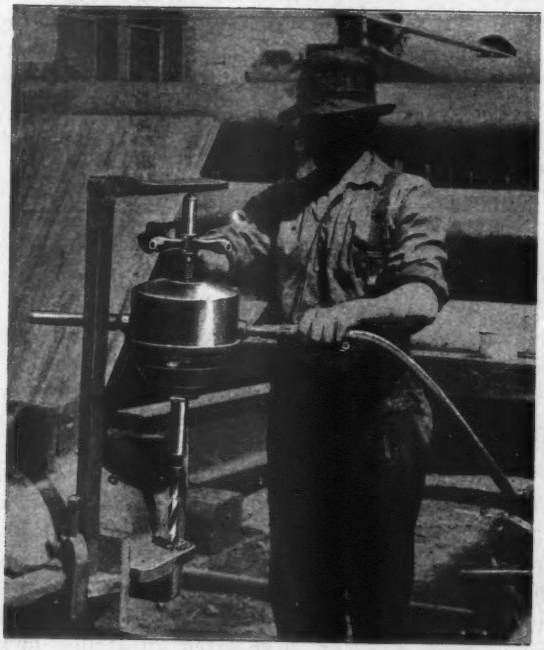
There are, of course, numerous special employments of compressed air in foundry work peculiarly adaptable to individual conditions but not of general interest or application, reference to which is not within the province of this paper, but such applications suggest the inevitable conclusion that when once you have compressed air available, the number of convenient and economical possibilities that it presents to the progressive operator is surprising, and its field of usefulness in your service broadens with amazing, but none the less gratifying, rapidity. Second only to electricity in its fascinating possibilities, compressed air yields nothing to electricity as a power with properties peculiarly its own, inimitable and unsurpassed in the commercial development of our time, and with the constantly rising standard of efficiency in air compressing machinery, that most important source of power which regulates the value of pneu-



Pneumatic Revolving Crane.

matic appliances, more widespread adoption is inevitable. Imperfect and wasteful air compressors, possessing the primary virtue of cheapness but with all the faults in the mechanical calendar, will do more to offset the resultant value to be derived from the use of pneumatic foundry equipment, than labor antagonism, either secret or expressed. Therefore, to derive the utmost benefits from the installation of compressed air machinery, the selection of a compressor should be carefully considered. It is unwise to install a compressor just about equal in capacity to present requirements, good practice being to provide a compressor at least 50 per cent. greater in capacity than immediate necessities demand. Compressors of the duplex type are divisible, permitting the installation and operation of one-half at first, and the other half when the additional capacity is needed. The theoretical capacity of an air compressor stated in the list of the maker, is not the equivalent of the actual volume of air needed for the service. All makers list their compressors according to theoretical measurement, but the efficiency of the compressor is determined by the volume of air actually delivered with a given consumption of power. The cheap air compressor usually proves the most expensive. If a water pump fails in its work, or if a steam engine is deficient, the short-comings are self-evident, but if an air compressor is poorly designed or badly constructed, it may continue in the evil of its ways until the scrap heap claims it for its own; unless, as is more likely, an absolute breakdown calls attention to its deficiencies and shows, all too late, that the hole it has made in the coal pile, added to the cost of keeping it in repair, would have paid a handsome interest on the additional first cost of a properly designed and properly constructed compressor. Second-hand compressors are poor investments, unless known to have given satisfaction in service similar to that for which intended, and, in any case, the working parts should be carefully examined to see that they retain their full measure of usefulness. An air compressor with valves, pistons, etc., worn out or in bad repair, can waste a great amount of power.

The use of air brake pumps and direct-acting compressors is very bad practice, as statistics show that their steam consumption is about five times that of a crank and fly-wheel compressor for the same volume and pressure of air delivered. Install a



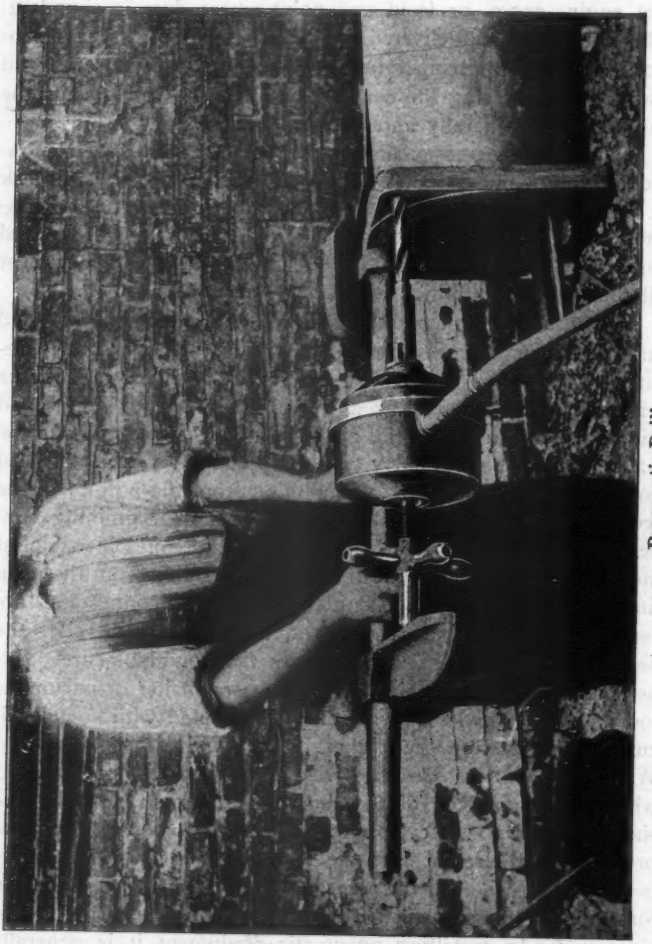
Pneumatic Drill.

steam-driven compressor, if your steam supply is plenty; otherwise a belted compressor may serve best.

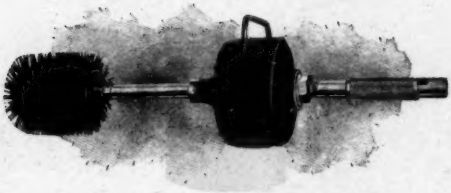
Intake air to the compressor should not be drawn from a hot engine room, or from any point where dust is abundant. The volume of air delivered by the compressor increases proportionately as the temperature of the intake air is lowered, and dust or grit entering the compressor clogs the valves, cuts the cylinders and generally impairs the efficiency.

The selection of an air receiver should have careful consideration. Compressed air under 100 pounds pressure will leak a horse-power through a 1-16th inch diameter hole in five minutes, and a well made, strong and tight air receiver is the second essentially important factor if you would realize to the utmost all the advantages which compressed air provides.

Test the air-piping under full pressure when it is installed and at regular intervals thereafter, allowing the pressure to remain an adequate length of time, and if the gauge indicates leakage, locate and remedy it. To secure the best results and eliminate moisture from the compressed air, connect your pipe leading from the compressor to the top of the receiver, and lead your air pipe to points of consumption from the bottom of the receiver. Proper provision should be made for draining condensed moisture at regular intervals in the system. The simplest method is to slightly incline the branches leading from the main line and insert drain cocks before the hose connections are reached. In pneumatic equipment, as in all things else, the proverbial ounce of prevention saves the pound of cure. Experienced knowledge which the compressor maker or pneumatic tool manufacturer is ready to provide, coupled with sound calculation, will assure the highest results and utmost economy. Whether to put in a steam-driven or belt-actuated compressor; whether it should be of the duplex or single type and have simple or compound cylinders; where best to locate the compressor and where to place the receiver; what size of receiver is adequate; whether the size of the plant warrants provision for reheating the air—all these are points requiring careful consideration. In installing pneumatic equipment it is generally desirable to procure the entire outfit from one source. Thus, division of responsibility for the successful operation of any feature of the plant is avoided, and one guarantee covers everything.



Pneumatic Drill.



Pneumatic Casting Cleaner.

Pneumatic Sand Rammer.

Pneumatic Paint Machine.

Pneumatic Sand Sifter.